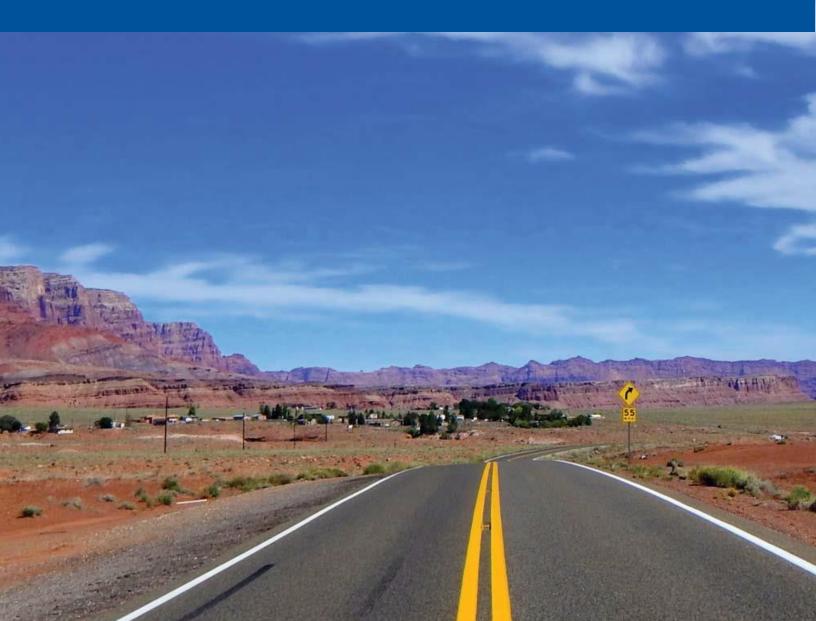
WhatMovesYouArizona

Arizona Long Range Transportation Plan Update
Final Working Paper #5:

Recommended Investment Choice (RIC) Development
October 2017



WhatMovesYouArizona

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WhatMovesYouArizona

1. INTRODUCTION

This technical memorandum documents development of the Recommended Investment Choice or "RIC" for the Arizona Long Range Transportation Plan (LRTP) Update entitled What Moves You Arizona (WMYA) 2040. It provides context on the RIC's history and purpose, summarizes the research and analysis that supported development of the RIC, and describes the planning process that led to its establishment as a cornerstone of WMYA 2040.

1.1 History and Context – The WMYA 2035 RIC

The original concept of a "recommended investment choice" was established as part of the Arizona Department of Transportation (ADOT) current long-range transportation plan (LRTP), referenced as WMYA 2035. The RIC was intended to provide a target allocation of resources across three major investment categories (preservation, modernization, and expansion) to:
1) guide ADOT's annual budgeting and programming processes; and 2) serve as a strategic foundation for the Department's transition to more performance-based project selection. The distribution of funding for these three categories, as adopted in the WYMA 2035 RIC, is illustrated in Figure 1.

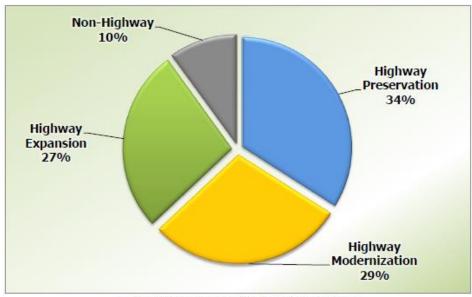


Figure 1: WMYA 2035 Recommended Investment Choice (RIC)

Source: Wilbur Smith Associates for ADOT's 2035 LRTP

The RIC:

- Matches AIC A highway preservation funding (34 percent);
- Provides some funding for modal options (10 percent); and,
- Allocates similar amounts to the remaining categories of modernization (29 percent) and expansion (27 percent).

At the time the WMYA 2035 RIC was developed, ADOT had only recently started establishing and using performance measures and had limited performance forecasting capabilities. Establishment of the RIC was thus based on fairly subjective considerations relating to anticipated impacts different resource allocation strategies would have on future transportation system performance. Nonetheless, the WMYA 2035 RIC created important changes in ADOT's strategic direction: 1) ADOT shifted the focus of long-range planning efforts from creating a 25-year list of projects to setting policy on how resources are allocated; and 2) it envisioned a shift in ADOT investments in highways shifted from physical expansion of highways to preservation of existing facilities.

1.2 Purpose of the WMYA 2040 RIC

As with the WMYA 2035 RIC, the new RIC defines how ADOT intends to allocate future funding for the State Highway System (SHS) across the three major investment categories:

- Preservation Spending to maintain highway pavements in good condition and maintain bridges in a state of good repair;
- Modernization Non-capacity enhancing spending to improve safety and operations of the existing SHS through activities such as adding shoulders and implementing smart road technologies; and
- **Expansion** Improvements that add capacity to the SHS through new roads, adding lanes to existing highways, and constructing new interchanges.

In addition, the new WMYA 2040 RIC goes a step further by including two tiers. The first is a consolidated RIC that rolls up how ADOT anticipates its total future expenditures will be allocated statewide. The second tier is a set of three RICs that identify how resources will be allocated in Greater Arizona, the Maricopa Associates of Governments (MAG) region, and the Pima Associate of Governments (PAG) region.¹ The MAG and PAG RICs reflect spending decisions and priorities each region has established in their current long-range Metropolitan Transportation Plans (MTPs).

It is important to recognize that neither the statewide nor the regional RICs are meant to prescribe a rigid allocation of resources; rather, the RICs are intended to establish a starting point for annual discussions about investment priorities. That is to say, ADOT and its partners possess the flexibility to adjust suggested RIC allocations based on changing circumstances and priorities.

2. RIC DEVELOPMENT PROCESS OVERVIEW

For WMYA 2040, ADOT built from the WMYA 2035 RIC approach to conduct a more robust RIC development process that was both data-driven and incorporated significant input from

¹ Based on a memorandum of understanding known as the Casa Grande Resolves, certain ADOT funds are allocated by formula to the Phoenix region (MAG), the Tuscan region (PAG), and the remainder of the State (Greater Arizona).

stakeholders and the public. The process centered on developing a series of Alternative Investment Choices (AICs) that represented different perspectives on how ADOT's resources could or should be allocated in the future. The AICs, in effect, served as data points to inform development of the final RIC. The steps for developing the AICs and RIC are briefly described below, with detailed documentation of each step provided in the subsequent sections of this working paper.

- 1. Assembling the Building Blocks To support development of the AICs, ADOT built from goals and objectives established earlier in the planning process to define a strategic framework of investment areas and associated performance measures. This step also included refining research and analysis on needs for each of the investment areas and available revenues over the 25-year WMYA 2040 planning period.
- **2. Evaluating Current Spending** To provide a baseline for comparison, a "Current Plan AIC" was developed by extrapolating planned spending in the MAG and PAG MTPs and ADOT's most recent 5-year Capital Plans (for Greater Arizona) to identify a status quo allocation of resources.
- **3. Scenario Analysis** Application of a decision science tool to enable ADOT staff and stakeholders to evaluate the system performance implications of different investment scenarios and develop consensus around a recommended resource allocation approach known as the "Agency AIC."
- **4. Gathering Public Input** Use of an online survey tool to educate citizens about transportation investment tradeoffs and gain widespread public input about relative priorities and how to spend limited transportation dollars. The results from the survey were then translated into a "Public AIC."
- 5. Developing the Final RIC The final overall Statewide and Greater Arizona RICs were developed through an iterative process engaging the WMYA 2040 planning team and ADOT leadership to evaluate the AICs and build consensus around the final RICs. The MAG and PAG RICs were developed based on the MTPs for the two respective regions.

3. THE RIC BUILDING BLOCKS

The following section describes how earlier elements of the WMYA 2040 plan development effort were brought together and refined to support development of the AICs and RICs.

3.1 Needs

Working Paper #3, entitled *Existing Conditions, Deficiencies, and Future Needs*, was completed in February, 2017. This working paper documents preliminary development of needs estimates for WMYA 2040. The development of the needs forecast required both significant technical modeling as well as synthesis and extrapolation of various studies and research to estimate highway investment needs that will be ADOT's responsibility for highway investment over the 25-year WMYA 2040 planning horizon. Arizona's SHS needs include estimated costs for

pavement and bridge preservation, modernization (e.g., upgrading existing highways, safety improvements, and Intelligent Transportation Systems (ITS) deployment), and expansion (e.g., added capacity, new alignments, and new interchanges). In addition, the determination of needs identifies optimal spending on Operations and Maintenance (O&M) for the SHS (e.g., patching potholes, fixing guardrails, mowing, and snow removal).

While Working Paper #3 provided solid initial needs forecasts, some estimates have since been refined as additional information has become available and/or the planning process has led ADOT to reconsider how certain types of needs should be categorized. In particular, some bridge needs were reclassified from modernization to preservation, expansion needs were increased significantly to incorporate the addition of lanes to existing roads and new roads identified through the Corridor Profile Studies, and estimated O&M needs were revised upward to reflect additional costs associated with the MAG-area portion of the SHS. The final 25-year statewide highway capital needs used in the RIC development process and included in the final WMYA 2040 Plan document are presented in Table 1.

25-Year Need **Investment Category** (Billions of Constant \$) Preservation **Pavement** \$7,902 \$1,334 Bridge \$9,236 **Subtotal Preservation** Modernization \$4,273 Highways \$400 Bridge Safety \$1,934 \$3,255 ITS/Technology **Subtotal Modernization** \$9,862 **Expansion** \$17,561 **Existing Highway Expansion** \$13,770 New Roads **New Bridges** \$403 **New Interchanges** \$2,320 **Subtotal Expansion** \$34,054

Table 1: 25-Year Statewide Highway Capital Needs

3.2 Revenues

The revenue figure used to support development of the AICs and RIC was derived from the 25year revenue estimate documented in Working Paper #4, entitled Revenue Forecast and Gap Analysis, which was completed in April, 2017.. The baseline forecast was developed in

Total 25-Year Highway Needs

\$53,152

consultation with ADOT's Office of Financial Management Services and MAG officials. It provides an estimate of funding anticipated to be available for capital spending from the State's Highway User Revenue Fund (HURF), Regional Area Road Fund (RARF), and federal sources. After allocations for O&M and support to local transit agencies, the forecast indicates about \$23 billion in constant dollars will be available for highway capital spending over the 25-Year WMYA 2040 planning horizon. On an annual basis, this equates to an average annual revenue figure of \$923 million, which was used as the available funding figure for developing the Statewide and regional RICs.

3.3 Strategic Framework

A critical part of preparing for development of the WMYA 2040 AICs and RIC was creating the strategic framework for considering different resource allocation strategies. The WMYA 2040 goals and objectives (documented in Working Paper #2, dated June, 2016) were established early in the WMYA 2040 planning effort through a process that included workshops with ADOT staff and stakeholders in conjunction with extensive public outreach. As illustrated in Figure 2, the foundation for the framework was based on three system-related goal areas: 1) Mobility, Reliability & Accessibility; 2) Safety; and 3) Preservation. These three area were expanded upon to identify specific "Investment Types" and associated "Performance Metrics" that could be used to help quantify future system performance under different allocation schemes. The investment areas then were then rolled-up into the same three "Major Investment Categories" (expansion, modernization, and preservation) used for the WMYA 2035 RIC.

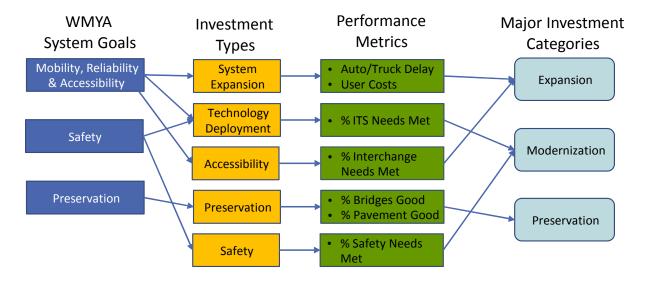


Figure 2: Strategic Framework for AIC/RIC Development

4. CURRENT PLAN AIC

TOTAL

\$

1,073

To provide perspective for development of AICs and RICs for Greater Arizona, MAG, and PAG, the planning team developed a snapshot of how future ADOT resources would be allocated to different investment types,² if no changes were made to current and planned capital spending of ADOT resources on the SHS. Development of this snapshot, called the "Current Plan AIC," was based on SHS spending identified in the following sources:

- The MAG 2035 Regional Transportation Plan Covers the MAG (Phoenix) region;
- PAG 2045 Regional Transportation Plan Covers the PAG (Tucson) region; and
- ADOT Five-Year Capital Plans Information was pulled from the FY15-FY19, FY16-FY20, and FY17-FY21 plans to determine capital highway spending in the Greater Arizona region.

Due to different planning horizons and program structures in these plans (e.g., spending categories varied), the planning team worked closely with MAG and PAG officials to reach agreement on how to extrapolate plan information to the 25-year WMYA 2040 planning horizon. This process necessarily involved judgments calls as to how funding should be categorized.

Table 2 shows the resulting annual average allocations for the three regions by investment area (expansion, modernization, preservation, and O&M) and investment type (safety, bridge, pavement, expansion, technology, accessibility, and O&M). As such, it documents what was used in the RIC development process as the Current Plan AIC.

Statewide Allocation Greater Arizona MAG PAG **Investment Type** % of Total Spending % of Total Spending % of Total Spending % of Total Spending Safety and Modernization \$ 96 9% \$ 82 15% \$ 13 3% 2% 2 Bridge \$ 40 4% \$ 40 7% \$ 0% 0% \$ 224 218 6 0% Pavement 21% \$ 40% \$ 1% Expansion 45% \$ \$ 482 45 8% \$ 343 84% 93 78% Technology \$ 12 1% \$ 3 1% \$ 7 2% 2 2% Accessibility \$ 67 6% \$ 21 4% \$ 23 6% \$ 23 19% \$ 25% \$ M&0 152 14% \$ 138 14 3% 0% Ś 1,073 100% \$ 547 100% \$ 100% TOTAL 406 100% 120 **Major Investment Category** Preservation 264 25% \$ 258 47% \$ 6 1% 0% Modernization \$ 175 16% \$ 106 19% \$ 43 11% 27.00 23% \$ 482 45% 45 8% \$ 343 84% 93.00 78% Expansion \$ \$ 152 14% \$ 138 25% \$ \$ 0% 0&M 14 3%

Table 2: Current Plan AIC

547

100% \$

100% \$

406

100%

100%

120

² Investment categories" refer to the three major spending areas of preservation, modernization, and expansion. "Investment types" are more specific types of spending that roll up into the major investment categories.

5. SCENARIO PLANNING

During the WMYA 2040 RIC development process, the planning team conducted a combination scenario planning webinar and workshop with ADOT staff and stakeholders. This process incorporated Decision Lens Optimization Software to assess what the state's transportation experts think Arizona's highway investment priorities. The process allowed the planning team to gain input on how the experts think ADOT should allocate resource to different types of investments.

5.1 Performance Curves

The first step in the scenario planning process was to establish "performance curves" that define anticipated performance outcomes at different spending levels for a specific investment type. The performances curves were critical to enabling scenario planning participants to see how changes in resource allocation strategies potentially affect system performance. This aided the participants to make more informed decisions regarding tradeoffs between spending on different investment types. The effectiveness of scenario planning is affected by the ability to develop meaningful curves, which varies depending on the availability of data and analytical methods to forecast future system performance. In some cases, good outcome-oriented performance curves can be established. In in other cases, however, curves may simply need to reflect the percent of identified needs met at a given allocation level. The methodological elements employed to develop performance curves for each investment area in support of the WMYA 2040 scenario planning effort are summarized in Table 3.

Performance Curve Methodology **Investment Area** Travel demand model runs for different levels of building out projects identified in Corridor Profile Studies were used to develop Expansion performance curves, based on changes in projected daily hours of delay, average truck speed, and travel time index. Current system performance data and deterioration curves were used Preservation to project the percent of pavement and bridge decking in "poor" condition, by system tier (Interstate vs. National Highway System). Percent of direct safety needs met Safety Technology Percent of ITS/technology needs met Percent of new/improved interchange needs met Accessibility Percent of identified O&M needs met 0&M

Table 3: Investment Curve Methodology

5.2 Pairwise Comparison

Prior to the scenario planning workshop, a two-hour webinar was conducted to explain the scenario development process to invitees, introduce them to the Decision Lens Optimization

Software, and provide directions for identifying their relative priority for the following six investment types through a pairwise comparison survey³:

- Expansion;
- Preservation;
- Safety;

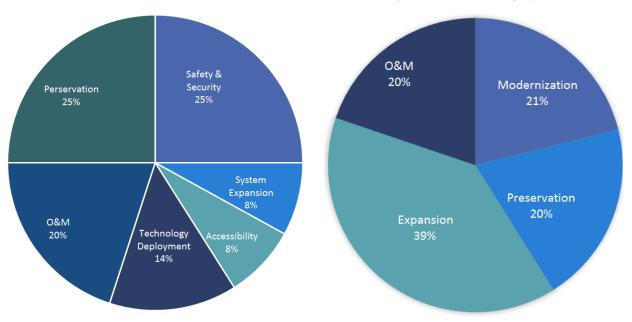
- Technology;
- Accessibility; and
- 0&M

A total of 56 people responded to the survey (participants had a week to respond), representing: ADOT headquarters and field staff; MPOs, COGs, and other partner agencies; and State Transportation Board members. The results of this survey led to an average priority weighting for each investment type, as illustrated in Figure 3. Priorities are reflected by how respondents (as a whole) would weigh the importance of different improvements types, when asked to allocate funding among them.

The Decision Lens optimization module then was used to translate the weighting results into a "Baseline Allocation of Resources." The resulting percentages of total funding that would be allocated to each major investment category are shown in Figure 4.4

Figure 3: Average Investment Type Weighting





³ A "Pairwise Comparison" asks a respondent to identify their relative priority between two different options, such as safety vs. technology investment.

⁴ During the scenario planning exercise, O&M was considered a fourth "Major Investment Category."

5.3 Scenario Workshop

The results from the Pairwise Comparison were presented to participants at a one-day scenario planning workshop held in August, 2016, which was attended by more than 60 transportation stakeholders from ADOT, MPOs and COGs, and other interested organizations. A demonstration of the Decision Lens tool was presented, then attendees were assigned to one of three breakout groups and asked to discuss their reactions and thoughts about the pairwise results and associated *Baseline Allocation of Resources*. Each breakout group then worked with a facilitator to develop consensus around a recommended allocation of resources to different investment types and associated forecasts of system performance.

The discussions were supported by use of Decision Lens work stations that enabled participants to see the performance tradeoffs as funding was shifted from one investment type to another in real time. The resulting allocation for each breakout group, the overall workshop average, and the funding range for each investment area are summarized in Table 4. The workshop average then became known as the "Agency AIC" (since most of those who participated were either ADOT staff or personnel from MPOs and COGs) and became an important data point for development of the final RIC; a roll-up of this AIC to the major investment categories is provided in Table 5.

Annual Resource Allocations Investment Type Workshop Funding **Baseline** Group 1 Group 2 Group 3 **Average** Range Safety \$77 \$77 \$50 \$72 \$66 \$50 to \$77 \$50 Bridge \$50 \$55 \$61 \$55 \$50 to \$61 Pavement \$150 \$269 \$315 \$200 \$261 \$200 to \$315 Expansion \$295 \$342 \$235 \$295 \$291 \$235 to \$342 Technology \$134 \$95 \$80 \$100 \$100 \$80 to \$124 \$48 \$48 to \$65 Accessibility \$96 \$65 \$54 \$54 0&M \$198 \$120 \$200 \$173 \$173 \$120 to \$200 **TOTAL** \$1,000 \$1,000 \$1,000 \$1,000 \$1,000

Table 4: Scenario Planning Workshop Results (\$ millions)

Table 5: Agency AIC (\$ millions)

Major Investment Category	Annual Allocation
Preservation	\$316
Modernization	\$220
Expansion	\$291
O&M	\$173
TOTAL	\$1,000

6. GENERAL PUBLIC'S INVESTMENT PRIORITIES

To gain the general public's input about investment priorities and inform development of the RIC, ADOT conducted an online interactive community engagement for two months in Fall 2016, using *MetroQuest*, a web-based software tool.

6.1 Conducting the Survey

The online survey site consisted of five sections (see Figure 5 for example) that guided participants through the process of learning about the WMYA 2040 development initiative. This site enabled participants of the survey to provide input on highway investment priorities and had them respond to several demographic questions. The five survey sections included:

- 1. **Welcome** Introduced visitors to the survey and provided basic information about Arizona's transportation system;
- 2. Priority Ranking Asked visitors to rank the importance of different investment types;
- 3. **Budget Allocation** Enabled participants to show how they would allocate \$100 to different investment types;
- 4. **Tradeoffs** Asked respondents to say how they felt about different transportation investment tradeoffs; and
- 5. Wrap Up Collected demographic data.



Figure 5: Example of MetroQuest Survey Page

Statewide, there were more than 14,000 visits to the site, resulting in nearly 6,000 individuals using the tool to provide their opinions regarding transportation priorities and potential

tradeoffs. To increase interest in the study and use of the website, traditional and non-traditional communications and advertising, including Facebook) were used, and publicity was successfully achieved through a series of press releases.

6.2 Survey Results

The online survey provided significant input to the planning process on people's investment priorities. As illustrated in Figure 6, which shows how people ranked the different investment types, the public views safety as most important, followed by expansion. However, both O&M and preservation also ranked high and, when considered together, are a high priority for the public. This is reinforced by the results, as shown in Figure 7, that, given a \$100 to spend on transportation, the general public would spend nearly half the funding on just preservation and O&M. Moreover, the share of funding the public would allocate to preservation and O&M spending was even higher for respondents living in Greater Arizona (i.e., outside the Phoenix and Tucson metropolitan areas).⁵

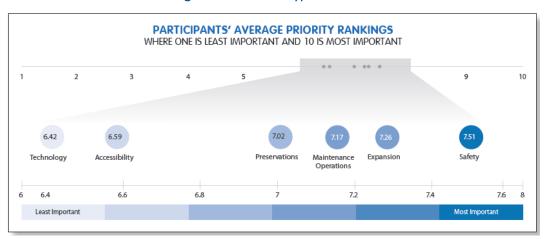


Figure 6: Invement Type Priorities

Figure 7: Survey "Allocation of Funding" Results



⁵ See https://www.azdot.gov/docs/default-source/planning/lrtp-alternative-investment-choices.pdf?sfvrsn=2 for Full results of the survey.

6.3 Public AIC

The WMYA 2040 planning team translated the survey results into another potential resource allocation strategy (using the same \$1 billion per year in available annual funding that was used with the Agency AIC). This new strategy became known as the "Public AIC," and it provided an alternative data point to the Current Plan and Agency AICs to inform RIC development. The resulting allocation of resources under the Public AIC is presented by investment area in Table 6, and rolled up by Major Investment category in

Table 7.

Table 6: Public AIC by Investment Type (\$ millions)

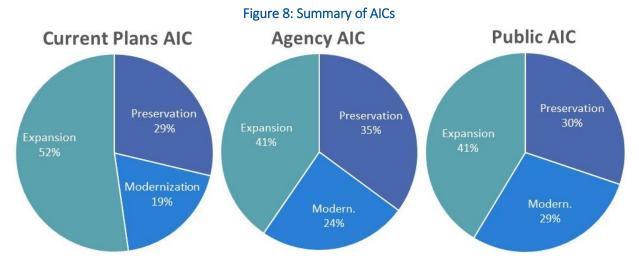
Investment Type	Annual Allocation	
Safety	\$77	
Bridge	\$50	
Pavement	\$150	
Expansion	\$295	
Technology	\$134	
Accessibility	\$96	
O&M	\$198	
TOTAL	\$1,000	

Table 7: Public AIC by Major Investment Category (\$ millions)

Major Investment Category	Annual Allocation
Preservation	\$200
Modernization	\$307
Expansion	\$295
0&M	\$198
TOTAL	\$1,000

7. THE WMYA 2040 RIC

Development of the final RIC was heavily informed by the three AICs (summarized in Figure 8), which provided important perspectives on both how ADOT's limited resources could be allocated, and how different interests view the relative priority of different investment types and associated system performance outcomes.



7.1 Developing the Final RICs

The ADOT Priority Planning Advisory Committee (PPAC)⁶ took the lead role in building from the AICs to develop the final WMYA 2040 RIC that was recommended to the Arizona Transportation Board for their approval. This effort was accomplished through a series of PPAC meetings (these were open to the public), where they held detailed discussions regarding: WMYA 2040 goals and objectives; highway needs identified through plan research; system performance and federal requirements considerations; stakeholder and public input provided during the planning process; and the need to provide programmatic flexibility. The resulting final WMYA 2040 RIC, shown in Figure 9 and Figure 10, reflect three important elements, as discussed below.

Strategic Framework Refinement – ADOT leadership decided that, because annual O&M spending levels are determined independently by the Arizona Legislature and ADOT does not have the ability to allocate these funds to highway capital spending, O&M needs should be excluded from the RIC. This finding also required reducing the level of anticipated annual available funding to

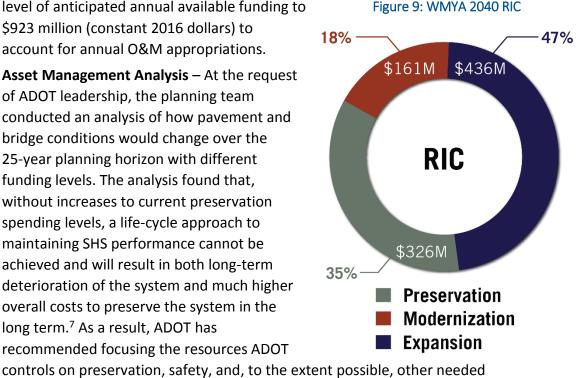
\$923 million (constant 2016 dollars) to account for annual O&M appropriations.

Asset Management Analysis – At the request of ADOT leadership, the planning team conducted an analysis of how pavement and bridge conditions would change over the 25-year planning horizon with different funding levels. The analysis found that, without increases to current preservation spending levels, a life-cycle approach to maintaining SHS performance cannot be achieved and will result in both long-term deterioration of the system and much higher overall costs to preserve the system in the

recommended focusing the resources ADOT

modernization improvements to the existing system.

long term.⁷ As a result, ADOT has



Two-Tier RIC Structure – The WMYA 2035 RIC focused solely on how ADOT's overall funding should be allocated. While this was effective in helping shift the long-range

⁶ The PPAC is appointed by the ADOT director and responsible for preparing the five-year transportation facilities construction program.

⁷ A "life-cycle approach" to system preservation seeks to optimize the timing of pavement and bridge treatments to achieve the lowest overall preservation costs over the life of facilities, and reflects the concept that \$1 of deferred minor treatments today may require \$4 to \$5 of major treatments at a later date.

plan from a project-oriented plan to a policy plan, it did not address the difference between how ADOT funding controlled by MAG and PAG would be spent vs. how ADOT-controlled funding would be allocated. To address this, the PPAC recommended creating two tiers of RICs. The first tier provides guidance on how ADOT's overall capital funding should be allocated to preservation, modernization, and expansion. The second tier identifies how ADOT funds will be allocated in the MAG and PAG areas (based on their respective MTPs) and in the Greater Arizona area.

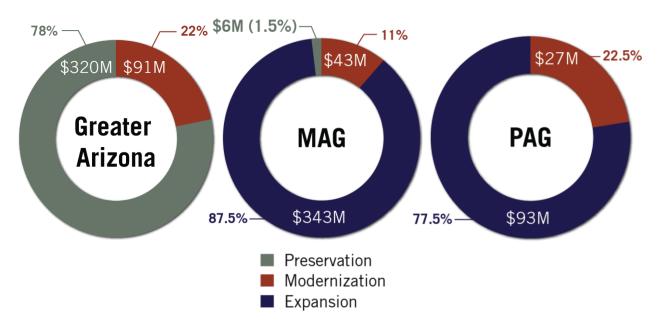


Figure 10: Greater Arizona, MAG and PAG RICs

7.2 Next Steps

The WMYA 2040 RICs provide important policy direction that will position ADOT to transition to more data-driven and performance-based decision-making transportation investments in the future. To successfully implement the long- range transportation plan, ADOT will focus on initiatives in four areas:

- Resource Allocation The new RIC represents a significant shift in state transportation investments from expansion to preservation. This shift cannot occur "overnight," as Greater Arizona expansion projects are still in the pipeline. ADOT intends to implement expansion projects that are already programmed in the Fiscal Year (FY) 2018-2022 Five-Year Program and will carefully consider expansion decisions beyond FY 2022.
- Performance Measurement The WMYA 2040 planning process established and applied basic performance measures to inform development of the RIC, but ADOT will need to further refine its performance measures and their applications to both monitor progress of plan implementation and comply with new national transportation performance measurement reporting requirements.

- Target Setting In conjunction with the national transportation performance
 measurement initiative, ADOT will need to establish targets for future system
 performance the state hopes to achieve. Developing meaningful targets will require
 ADOT to better forecast how its investments will influence performance in areas such as
 safety, preservation and mobility.
- Project Selection Over the last few years, ADOT has been working to improve the linkage between its statewide long-range transportation plan and project programming through an initiative entitled Planning to Programming (P2P) Link. The WMYA 2040 Plan provides both a refined strategic direction and recommends increased focus on performance-based decision-making in ADOT's P2P process.